Earth Science Data Systems
Reuse Working Group Case Study:
SHAirED

Services for **H**elping the **Air**-quality community use **E**SE **D**ata

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Project Description

- The goal of this 5-year (start: 11/2004) REASoN applications and technology project is to deliver and use Earth Science Enterprise (ESE) data and tools in support of particulate air quality management and ultimately aims to develop a federated PM information sharing network that includes data from NASA, EPA, and US States.
- The project will:
  - develop access to distributed data (surface, model output and satellite),
  - build Web infrastructure
  - create tools for data processing and analysis.
- The key technologies used in the project include emerging web services for developing self describing and modular data access and processing tools, and service oriented architecture for chaining web services together to assemble customized air quality management applications. The technology and tools required for this project will be developed within **DataFed.net**, an infrastructure that supports collaborative atmospheric science data sharing and processing web services.

Project Scenario

- **Scenario:**

Smoke from Mexico causes record PM over the Eastern US.

- **AQ Management:**

Detect smoke emissions and predict PM and ozone concentration
Support air quality management and transportation safety

- **Impacts:**

PM and ozone air quality episodes, AQ standard exceedance
Transportation safety risks due to reduced visibility

- **Timeline:**

Routine satellite monitoring of fire and smoke
The smoke event triggers intensified sensing and analysis
The event is documented for science and management use

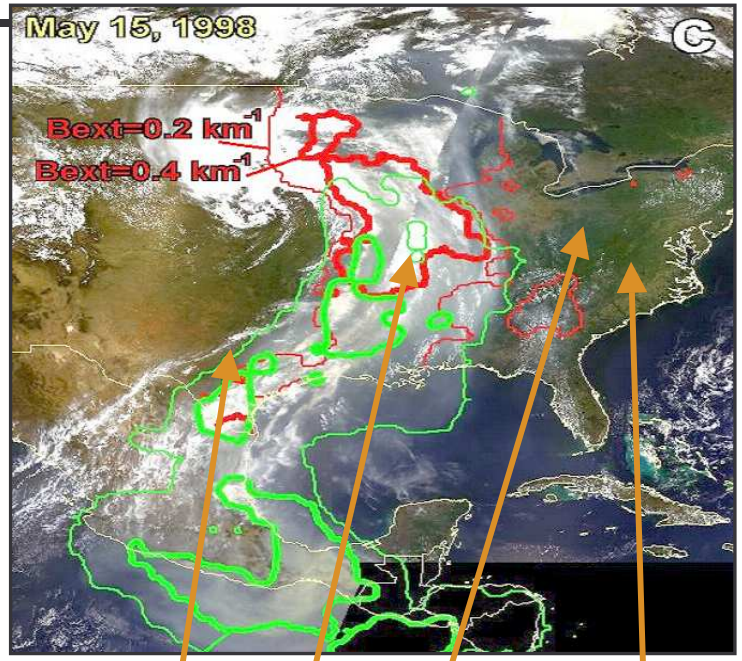
- **Science/Air Quality Information Needs:**

Quantitative real-time fire & smoke emission monitoring
PM, ozone forecast (3-5 days) based on smoke emissions data

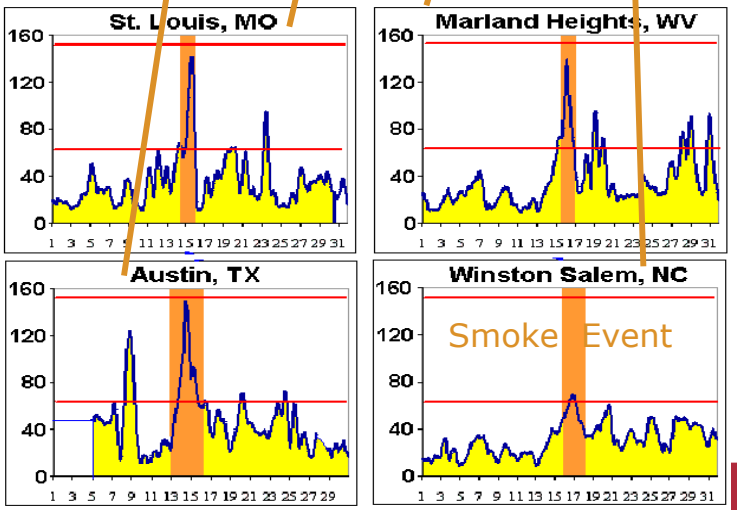
- **Information Technology Needs:**

Real-time access to routine and ad-hoc data and models
Analysis tools: browsing, fusion, data/model integration
Delivery of science-based event summary/forecast to air quality and aviation safety managers and to the public

Solution to meet needs: **AQ info network using web services**



Record Smoke Impact on PM Concentrations



Software Reuse Aspects of Project

The SHAirED project strives to adopt technology reuse practices as both a developer and user of reusable components.

Building Reusable Components

The goals of the technology development component of SHAirED is to develop web services that adhere to interoperability standards (SOAP, WSDL …) and foster reuse internally within the project and externally as collaborative links to other projects within the Earth Science Community.

Using Reusable Components

The project will seek existing data processing components that can assist in attaining its technology development objectives. Operational web services are in their infancy and more development is needed before we see complete sharing and chaining of web services among multiple servers.

Reuse Examples

Some examples of reuse to date:

Map Zoom-In Tool

Need: The spatial map view in the DataFed browser (http://webapps.datafed.net/dvoy_services/datafed.aspx) was difficult to navigate without a simple zoom in/out tool. The tool needed to be compatible with IE and Netscape/Firefox.

Reuse: After extensive searching and testing of zoom tools, the tools available through the Intergraph OGC WMS Viewer source code (http://imgs.intergraph.com/interop/wmsviewer.asp) was found to be a suitable solution.

Benefit: Software development cost savings.

OGC WMS Specification

Need: To make datasets cataloged in DataFed accessible through multiple paths.

Reuse: The OGC WMS specification (http://www.opengeospatial.org/specs/) allows map images to be shared using a known interface and opens data for access by a broad community.

Benefit: Building a DataFed WMS allows its spatial map images to be called and used in a variety of WMS clients. Therefore users gain access to DataFed output by 'reusing' a data access protocol rather than requiring a custom interface to DataFed. Conversely, DataFed can make use of other WMS servers without creating unique data 'wrappers' to each service. (http://www.datafed.net/DataLinks/OGC/OGC.htm)

Assessment of Software Reuse Experience

Many challenges are yet to be addressed in reuse:

Building Reusable Components

- The extra time and resources required to design reusable software (Does the extra cost bring the anticipated benefits)
- Where to expose and share services ('If we build it, they will come' does not apply)
- The evolving foundation of web services (Standards continue to change and advance)
- How to chain, or 'orchestrate', web services
- How to establish an environment in which feedback and advancements can be made by a community of users

Using Reusable Components

- Knowing what's available (How can we learn if someone has already built a reprojection service)
- How to incorporate other services or code (Does the extra cost of learning how a "third-party" component links to our development bring the anticipated benefits)

Participation in ESIP and ESDS (and other open forum venues) will help address these challenges as its members share the vision of interoperability among earth science data and tools. Experience gained in sharing services, building registries, and creating multi-provider applications will move everyone closer to a reusable system.